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Abstract: Whether higher productivity of the foreign firm increases host country welfare depends on whether the reason for foreign direct investment (FDI) is to save the trade cost or to get the advantage of cheap labor. We show that, if the reason for FDI is to get the advantage of cheap labor, higher productivity of the foreign firm may reduce host-country welfare. Higher productivity of the foreign firm always increases (may reduce) host-country welfare if the reason for FDI is to save trade cost, while the trade cost implies transportation cost (tariff). Thus, the present paper compliments the recent literature in international trade that explores the effects of the foreign firms' productivities on the incentives for FDI.

Key Words: Cheap labor; Foreign direct investment; Host-country welfare; Trade cost

JEL Classification: F21; F23

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1. Introduction

Many developing countries are now liberalizing their economies and trying to attract foreign direct investment (FDI). Empirical evidence shows that multinationals account for a significant portion of international trade. For example, using the data from 1999, Caves et al. (2002) has demonstrated that over 60% of multinational trade can be traced to a small set of developed countries and that 70% of their foreign direct investment (FDI) is hosted by industrial countries. This dominance of FDI over international trade has generated a significant of empirical and theoretical research.[1]

Multinationals often face the important choice of export vs. FDI, and the recent literature shows that the productivities of the multinationals may play important roles in this respect. Helpman et al. (2004) show if the reason for the FDI is to save trade cost, relatively more productive firms do FDI.[2] Head and Ries (2003) extends this line of research and show that if the reason for FDI is to get the advantage of lower cost of production, whether the more productive firms do FDI is ambiguous (Head and Ries, 2003). While both the papers show useful results about the foreign firms' equilibrium production strategies, they are silent about the implications of the productivities of the foreign firms on the host-country welfare, which may be important for designing FDI policies.

[1] For recent surveys on foreign direct investment, one may refer to Pack and Saggi (1997) and Saggi (2002).
[2] Helpman et al. (2004) extend the line of research conducted by Melitz (2003), which determines the relationship between firm productivity and the incentive for entering the export market.

In this paper, we use a simple model to show that whether higher productivity of the foreign firm increases host-country welfare depends on the reason for FDI. If the reason for doing FDI is to save trade cost, the incentive for FDI increases as the foreign firm becomes more productive, whereas, if the reason for doing FDI is to get the advantage of cheap labor, the incentive for FDI decreases with foreign firm's higher productivity if the foreign firm is already very productive.

The effects of the foreign firm's productivity on the host-country welfare show that if the reason for FDI is to save trade cost and the trade cost implies transportation cost, the higher productivity of the foreign firm always increases host-country welfare. However, if the trade cost implies tariff, the higher productivity of the foreign firm may reduce host-country welfare. But, if the reason for FDI is to get the advantage of cheap labor, the higher productivity of the foreign firm may reduce host-country welfare if the higher productivity of the foreign firm induces it to shift its production strategy from FDI to export.

Hence, if there is no other benefit from FDI such as knowledge spillover that may help the host-country firms, it is not necessary that a host-country will always be interested to attract a foreign firm with higher productivity. Therefore, a competent FDI policy is required depending on the main reason for FDI. For example, if the main reason for FDI is to get the advantage of lower wage rate, a host-country may provide higher incentive for FDI to a relatively higher productive foreign firm, who otherwise prefers to do exporting than FDI. In contrast, if the main reason for FDI is to save the trade cost, where tariff rate is the main element of the trade cost, a host-country may prefer to prevent a relatively higher productive foreign firm from doing FDI, who otherwise can do FDI.

The present paper is related to an earlier literature, which shows that free trade (where the foreign firm does exports) may reduce host-country welfare in an imperfectly competitive market (se, e.g., Brander, 1981, Markusen, 1981). However, unlike those papers, the present paper considers both trade (i.e., export by the foreign firm) and FDI, and *our results depend on how productivity improvement of the foreign firm affects its production or plant location strategy*. Further, we show that higher productivity of the foreign firm may reduce host-country welfare in an economy with foreign monopoly, which does not occur in the above-mentioned papers.

The remainder of the paper is organized as follows. The next section develops the model and provides the results. Section 3 concludes.

2. The model and results

Assume that there is a foreign firm who wants to sell its product in a foreign country, called host-country. Firm 1 can sell its product to the host-country either through export or through FDI. In case of export, firm 1 produces outputs in its home country and sells to the host-country. In case of FDI, firm 1 produces and sells in the host-country. However, under FDI, firm 1 needs to incur a fixed sunk cost F.

We assume that firm 1 has Leontief production function and, for simplicity, assume that it uses only labor as its factor of production. Labors are assumed to be immobile between the home country of firm 1 and the host-country. Assume that firm 1 needs λ units of labor to produce one unit of output. Lower value of λ implies that firm 1's productivity has increased. We assume that the input markets in both the home country of firm 1 and the host-country country are perfectly competitive. Wage rate in the home country is given by w.

The inverse market demand in the host-country is given by

$$P = a - q\,, \tag{1}$$

where the notations have usual meanings.

Hence, our setup is similar to the single industry case of Head and Ries (2003). However, it is trivial that replicating this industry n times will not change our qualitative results. It is worth mentioning that higher entry cost and significant product differentiation may be the reasons for creating foreign monopoly. Alternatively, we may assume that paten protection on firm 1's product may create foreign monopoly. We will discuss the implications of the existence of host-country firms in the concluding section.

2.1. FDI to save trade cost

In this subsection we consider that the incentive for FDI comes from the existence of trade cost under exporting. So, in this subsection we assume that the wage rates in both the home and the host countries are w but if firm 1 wants to do export, it has to incur a trade cost t per-unit output. FDI helps firm 1 to save the trade cost.

It is well known that trade cost may involve both transportation cost and tariff rate. However, it is clear that these interpretations of trade costs have different implications for the host-country welfare. If trade cost implies tariff rate then tariff revenue becomes a part of the host-country welfare and makes the host-country welfare different from the situation where trade cost implies transportation cost.

In the text of this paper, we will consider trade cost as transportation cost or exogenous tariff rate, which is determined outside of this model. In the **Appendix,** we show that our qualitative results hold for endogenous tariff rate, which maximizes the host-country welfare. Hence, it will also confirm that the predictions of Head and

Ries (2003) and Helpman et al. (2004), those are based on exogenous trade cost, hold even with endogenous trade cost.

If firm 1 does export, it maximizes the following expression:

$$\underset{q}{Max}(a-q-\lambda w-t)q\,. \tag{2}$$

Maximizing (2), we find that the equilibrium output and profit of firm 1 under export are respectively $q_x=\frac{(a-\lambda w-t)}{2}$ and $\pi_x=\frac{(a-\lambda w-t)^2}{4}$. Second order condition for maximization is satisfied. Further, for simplicity, we assume throughout our analysis that profit from export is always positive.

If firm 1 does FDI, it maximizes the following expression:

$$\underset{q}{Max}(a-q-\lambda w)q-F\,. \tag{3}$$

Maximizing (3), we find that the equilibrium output and profit of firm 1 under export are respectively $q_f=\frac{(a-\lambda w)}{2}$ and $\pi_f=\frac{(a-\lambda w)^2}{4}-F$. Second order condition for maximization is satisfied. Further, for simplicity, we assume throughout our analysis that net profit from FDI is always positive.

So, firm 1 does FDI if and only if

$$\pi_f=\frac{(a-\lambda w)^2}{4}-F>\frac{(a-\lambda w-t)^2}{4}=\pi_x,$$

or $$F<\frac{(2a-2\lambda w-t)t}{4}\equiv F_1\,. \tag{4}$$

Condition (4) shows that firm 1 does FDI if and only if $F<F_1$ but otherwise, firm 1 does export.

Proposition 1: *Firm 1's incentive for FDI increases with lower* λ.

Proof: Differentiating F_1 with respect to λ, we find that $\frac{\partial F_1}{\partial \lambda} = \frac{-wt}{2} < 0$.[3] Therefore, if λ reduces, it increases the value of F_1 and hence, increases the range of F over which firm 1 does FDI. Q.E.D.

The above proposition shows that if firm 1 becomes more productive, it has higher incentive for FDI. Since, here FDI saves trade cost, the productivity of firm 1, i.e., λ, does not affect the incentive for FDI directly but it affects the incentive for FDI indirectly by affecting the equilibrium output. As firm 1 becomes more productive, it increases firm 1's output and therefore, FDI helps to save higher amount of total trade cost, which is tq_f. So, the higher productivity of firm 1 increases its incentive for FDI.

The above discussion suggests that there are two effects of the higher productivity of firm 1: (1) technological effect (reducing λ) and (2) location effect (changing production or plant location strategy). The technological effect increases firm 1's output. However, since firm 1 may shift its production from export to FDI if it becomes more productive, this location effect may also increase output by saving the trade cost. So, if the reason for FDI is to save trade cost, it is clear that both these effects go in the same direction to increase output of firm 1.

It is important to note that if trade cost implies *exogenous* tariff rate then the location effect, by shifting production from export to FDI, generates lower tariff revenue for the host-country country, thus creating a negative impact on the host-

[3] Note that if trade cost implies tariff rate and is determined endogenously, it is important to see the effect of the higher productivity of the foreign firm on the tariff rate and its implication on the foreign firm's production strategy. We address this issue in the **Appendix**.

country welfare.[4] It is straightforward to see that if higher productivity of the foreign firm does not create location effect, the host-country welfare is always higher with higher productivity of the foreign firm in case of exogenously given tariff rate. Given the exogenous tariff rate, higher productivity of the foreign firm increases its output, thus increasing consumer surplus and the tariff revenue of the host-country, which, in turn, increases the host-country welfare.

Let us now see how higher productivity of the foreign firm affects the host-country welfare under exogenous tariff and when there is location effect. If trade cost implies exogenous tariff and firm 1's labor co-efficient reduces from λ_0 to λ_1 and also shifts firm 1's production from export to FDI, the host-country welfare under λ_0 and under λ_1 are respectively $\frac{(a-\lambda_0 w-t)^2}{8}+\frac{t(a-\lambda_0 w-t)}{2}$ and $\frac{(a-\lambda_1 w)^2}{8}$. Note that the second term in the host-country welfare under λ_0 is due to tariff revenue, which is zero if trade cost implies transport cost. Comparing welfare of the host-country under λ_0 and under λ_1, we find that higher productivity of the foreign firm increases the host-country welfare provided

$$(a-\lambda_1 w)^2-(a-\lambda_0 w)^2 > t(2a-2\lambda_0 w-3t). \qquad (5)$$

Hence, the following proposition is immediate.

Proposition 2: *Suppose the reason for FDI is to save trade cost.*

[4] Here, the host-country welfare is the sum of consumer surplus and tariff revenue. Since, we implicitly assume that there is no unemployment in our analysis, and since, the wage rates of the host-country workers are the same in this industry and in the alternative jobs, a change in the labor income in this industry following the productivity change of the foreign firm does not affect the host-country welfare. The implication of unemployment can be derived easily from our analysis.

(a) If trade cost implies transportation cost, higher productivity of firm 1 always increases the host-country welfare.

(b) If trade cost implies (exogenous) tariff, higher productivity of firm 1 increases the host-country welfare if higher productivity of firm 1 either (i) creates no location effect or (ii) creates location effect but satisfies condition (5).

2.2. FDI to get the advantage of cheap labor

In this subsection we consider that the reason for FDI is to get the advantage of cheap labor in the host-country. So, in this subsection we assume that there is not trade cost involved under export, i.e., $t = 0$, but wage rate in the host-country is lower by amount α compared to the wage rate in the home country of firm 1, where $\alpha \in (0, w]$. Therefore, the wage rate under export and FDI are respectively w and $(w - \alpha)$.

If firm 1 does export, it maximizes the following expression:

$$\underset{q}{Max}(a - q - \lambda w)q . \tag{6}$$

Maximizing (6), we find that the equilibrium output and profit of firm 1 under export are respectively $q_x = \frac{(a - \lambda w)}{2}$ and $\pi_x = \frac{(a - \lambda w)^2}{4}$. Second order condition for maximization is satisfied.

If firm 1 does FDI, it maximizes the following expression:

$$\underset{q}{Max}(a - q - \lambda(w - \alpha))q - F . \tag{7}$$

Maximizing (7), we find that equilibrium output and profit of firm 1 under export are respectively $q_f = \frac{(a - \lambda w + \lambda\alpha)}{2}$ and $\pi_f = \frac{(a - \lambda w + \lambda\alpha)^2}{4} - F$. Second order condition for maximization is satisfied.

So, firm 1 does FDI provided

$$\pi_f = \frac{(a-\lambda w+\lambda\alpha)^2}{4} - F > \frac{(a-\lambda w)^2}{4} = \pi_x,$$

or $$F < \frac{(2a-2\lambda w+\lambda\alpha)\lambda\alpha}{4} \equiv F_2 \qquad (8)$$

Condition (8) shows that firm 1 does FDI for $F < F_2$; otherwise, firm 1 does export.

Proposition 3: *Firm 1's incentive for doing FDI increases with lower* λ *provided* $\lambda \in (\lambda^*, \frac{a}{w})$, *where* $\lambda^* = \frac{a}{(2w-\alpha)}$. *But, firm 1's incentive for FDI decreases with lower* λ *for* $\lambda < \lambda^*$.

Proof: Differentiating F_2 with respect to λ, we find that $\frac{\partial F_2}{\partial \lambda} = \frac{\alpha(a-2\lambda w+\lambda\alpha)}{2}$.

So, $\frac{\partial F_2}{\partial \lambda} \gtreqless 0$ provided $\lambda \lesseqgtr \frac{a}{(2w-\alpha)} \equiv \lambda^*$. Since, profit of firm 1 under export is always positive it implies an upper bound on λ given by $\frac{a}{w}$, i.e., $\lambda < \frac{a}{w}$ in our analysis. It is easy to check that $\lambda^* \equiv \frac{a}{(2w-\alpha)} < \frac{a}{w}$ for all $\alpha < w$. Therefore, $\frac{\partial F_2}{\partial \lambda} < 0$ for $\lambda \in (\lambda^*, \frac{a}{w})$ and, in this situation, firm 1's incentive for FDI increases with lower λ. But, $\frac{\partial F_2}{\partial \lambda} > 0$ for $\lambda < \lambda^*$ and, in this situation, firm 1's incentive for FDI decrease with lower λ. This proves the result. Q.E.D.

The above proposition shows that if the incentive for FDI comes from the advantage of cheap labor, the relationship between the incentive for FDI and firm 1's productivity is ambiguous. If FDI gives the advantage of cheap labor, higher

productivity of firm 1 has both direct and indirect effects. Since, higher productivity of firm 1 reduces λ, it makes export relatively less costly and directly creates lower advantage of FDI. But, lower value of λ increases the incentive for FDI indirectly by affecting the equilibrium output of firm 1, which is higher under FDI. When λ is sufficiently high, the effect of a lower λ through higher equilibrium output under FDI dominates the direct effect of lower relative cost of export and makes FDI more attractive. But, if λ is sufficiently small, the difference between the equilibrium outputs under FDI and export is not sufficiently large. Hence, in this situation, the advantage from higher output under FDI is not sufficiently large and is dominated by the direct effect for relatively lower cost of export. So, if λ is sufficiently small, higher productivity of firm 1 reduces the incentive for FDI.

Unlike the previous subsection, where the reason for FDI is to save trade cost, the above proposition suggests that there may be conflicting effects on the host-country welfare if firm 1's productivity increases. If firm 1's productivity increases, it becomes more technologically efficient, which creates production efficiency. Hence, this technological effect creates positive impact on the host-country welfare. However, if $\lambda < \lambda^*$, firm 1 may shift its production strategy from FDI to export if it becomes more technologically efficient. Hence, in this situation, the location effect is opposite to the previous subsection and creates negative impact on the host-country welfare by shifting firm 1's production from the low wage country to the high wage country and hence, reducing its output.

Comparing consumer surplus of the host-country, which is also equal to the host-country welfare, we find that if firm 1's productivity increases from λ_0 to λ_1, and also shifts firm 1's production from FDI to export, consumer surplus reduces with the higher productivity of firm 1 provided

$$\alpha > \frac{w(\lambda_0 - \lambda_1)}{\lambda_0}. \quad (9)$$

So, if the wage rate in the host-country is sufficiently lower compared to the home country of firm 1, the higher productivity of firm 1 may reduce the host-country welfare if it shifts frm1's production from FDI to export.

But, if $\lambda \in (\lambda^*, \frac{a}{w})$, the above proposition shows that the location effect shifts firm 1's production strategy from export to FDI. Therefore, in this situation, the location effect also creates a positive effect on the host-country welfare by shifting its production from export (i.e., production from a high wage country) to FDI (i.e., production to a low wage country).

The above discussion is summarized in the following proposition.

Proposition 4: *Suppose the reason for FDI is to get the advantage of cheap labor.*

(a) If $\lambda < \lambda^*$*, higher productivity of firm 1 reduces the host-country welfare when it shifts firm 1's production strategy from FDI to export and condition (9) holds.*

(b) If $\lambda \in (\lambda^*, \frac{a}{w})$*, higher productivity of firm 1 always increases the host-country welfare.*

3. Conclusion

Two important reasons for observing FDI are the trade cost saving and the benefits of cheap labor. We show that the effects of these incentives for FDI may affect the host-country welfare significantly. Hence, while designing FDI polices, the governments need to be careful about the reason for FDI.

The relationship between the productivity of the foreign firm and the incentive for FDI is positive if the reason for FDI is to save trade cost, while the relationship may be negative if the reason for FDI is to get the advantage of cheap labor. If the reason for FDI is to get the advantage of cheap labor, the incentive for FDI increases (decreases) with foreign firm's higher productivity if the initial technology of the foreign firm is sufficiently inferior (superior).

We show that if the reason for FDI is to get the advantage of cheap labor, higher productivity of the foreign firm may reduce host-country welfare, while higher productivity of the foreign firm always increases host-country welfare if the reason for FDI is to save trade cost and trade cost implies transportation cost. If trade cost implies tariff, the host-country welfare may reduce with higher productivity of the foreign firm even if the reason for FDI is to save trade cost.

In our analysis, we have focused on the production strategy of a foreign monopolist, thus ignoring the effects of FDI and exporting on the profitability of the host-country firms. However, it should be immediate that since the marginal cost of the foreign firm is lower under FDI (irrespective of the reason for FDI) compared to export, if higher productivity of the foreign firm increase the incentive for FDI, it increase the possibility of lower host-country welfare by reducing the profits of the host-country firms. But, if higher productivity of the foreign firm reduces the incentive for FDI, it helps to increase host-country welfare by increasing the profits of the host-country firms.

Appendix

Trade cost as endogenous tariff rate: Let us consider trade cost as endogenously determined tariff rate, which maximizes host-country welfare.

Consider the following game for this situation. At stage 1, firm 1 decides whether to do FDI or export. If firm 1 decides to do export, in stage 2, the host-country government chooses the tariff rate to maximize the host-country welfare. At stage 3, production takes place and the profits are realized.[5] We solve the game through backward induction.

If firm 1 decides to do FDI, there is no tariff rate and the profit of firm 1 is

$$\pi_f = \frac{(a-\lambda w)^2}{4} - F, \tag{A1}$$

for a given value of λ.

But, if firm 1 decides to do export, its profit is

$$\pi_x = \frac{(a-\lambda w-t)^2}{4}, \tag{A2}$$

given the welfare maximizing unit tariff rate t, and λ.

If firm 1 does exports, the host-country government chooses t to maximize the host-country welfare, which is the sum of tariff revenue and consumer surplus. So, the host-country government maximizes the following expression:

$$\underset{t}{Max} \frac{4t(a-\lambda w-t)+(a-\lambda w-t)^2}{8}. \tag{A3}$$

Maximizing (A3), we find the equilibrium tariff rate is $t^* = \frac{(a-\lambda w)}{3}$. Second order condition for maximization is satisfied. So, given λ, the profit of firm 1 under export is

$$\pi_x = \frac{(a-\lambda w)^2}{9}. \tag{A4}$$

Therefore, given λ, firm 1 does FDI provided

$$F < \frac{5(a-\lambda w)^2}{36} \equiv F_1'. \tag{A5}$$

It is clear from (A5) that $\frac{\partial F_1'}{\partial \lambda} = -\frac{5(a-\lambda w)}{18} < 0$. So, the effect of the higher productivity of the foreign firm on the critical fixed cost of FDI is similar to the one shown in Proposition 1. So, it confirms our result of Proposition 1 even under *endogenous* tariff rate.

Now, we examine the effect of λ on the host-country welfare. If firm 1 does FDI the host-country welfare is

$$W_f = \frac{(a-\lambda w)^2}{8} \tag{A6}$$

While the host-country welfare under FDI by firm 1 is

$$W_x = \frac{(a-\lambda w)^2}{6}. \tag{A7}$$

It is clear from (A6) and (A7) that if the change in the firm 1's productivity does not affect its decision on FDI and export, higher productivity of firm 1 always increases the host-country welfare.

However, as we have seen the higher productivity of firm 1 increases its incentive for FDI. If firm 1's productivity increases from λ_0 to λ_1 (i.e., $\lambda_1 < \lambda_0$) and shifts its production decision from export to FDI, the host-country welfare under λ_0 and λ_1 are respectively $\frac{(a-\lambda_0 w)^2}{6}$ and $\frac{(a-\lambda_1 w)^2}{8}$. Comparing these expressions for

[5] This move of the game is consistent under the problem of 'time consistency' as mentioned in Aizenman (1992), Al-saadon and Das (1996), Kabiraj and Marjit (2003) and many others.

the host-country welfare, we find that higher productivity of firm 1 increases the host-country welfare provided

$$w > \frac{a(2-\sqrt{3})}{(2\lambda_0 - \lambda_1\sqrt{3})}. \tag{A8}$$

Given that firm 1's net profits under export and FDI are positive, w must be less than $\frac{a}{\lambda_0}$. We find that while (A8) does not hold with $w = 0$, it holds for $w = \frac{a}{\lambda_0}$. So, like Proposition 2(b), if firm 1's higher productivity creates the location effect but condition (A8) is satisfied, higher productivity of firm 1 increases the host-country welfare and confirms our result of Proposition 2 even under *endogenous* tariff.

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